REMARKS

Claims 1-13 are presently pending in the application. Claims 1 and 11-13 have been amended. Support for these amendments can be found on at least at paragraphs [0109] to [0124] and Figs 9 and 10 of the specification. No new matter has been added by the amendments and the new claims.

Principle of Operation

Where data is stored in multiple layers in an optical disk in which the layers are separated by approximately 25 microns and a protective layer of approximately 100 microns or so covers the disk, and where the focusing section has a high numerical aperture on the order of 0.85, particular problems present themselves for controlling the focus of the focusing section. One problem can arise when shifting the focusing section from one layer to another where the focusing section overshoots the target track due to inertia of the focusing section. In that instance, control of the head could be lost. In a particular case where the focusing section is shifted from an outer layer to the most inner layer, a head crash into the protective layer could occur. Accordingly, as described at paragraphs [0109] to [0124] of the application, one embodiment of the present invention is directed to a procedure for controlling the focus point of the focusing section to correct for any overshoot that might occur in the shifting of an focusing section from one layer to another.

Fig. 2 is a block diagram of the optical disk drive 100. As described at paragraphs [0052 to [0058], a focus detector 114 and a focus controller 116 act in conjunction with the vertical position changer 112 to acquire and maintain the focal point of the focusing section 110 on a target layer of the disk when the focal point is within the capture range of the focus controller 116. A control section comprising the focus jump controller 104, the first shifter 106 and the second shifter 108 act in concert to shift the focal point of the focusing section 110 from one layer of the disk to the target layer. As described at paragraph [0058], the purpose of the focus jump controller 104 is bring the focal point to a position relative to the target layer where the focus controller 116 can take over the

control of the focusing section. Thus, the focus controller and the focus jump controller act jointly to control the vertical displacement of the focusing section.

Of importance to understanding the claimed operation of the focusing operation is the characteristics of the signal generated by the focus detector 114, as described at paragraphs [0109] to [0124] and shown in Fig. 9. The focus detector generates a focus error signal, the polarity of which is negative when the focal point of the focusing section is on the side closest to the disk surface compared to the closest layer and positive when the focal point of the focusing section is farther away from the disk surface compared to the closest layer. The absolute value of the amplitude of the focus error signal rises as the focal point moves away from the closest layer until it reaches a point at the approximate midpoint between the layers where the amplitude drops to zero. Of importance to note is that the focus detector is operative only for a certain range around each layer. Consequently, a dead zone (points E and I) may be created between the layers such that if the focal point comes to a rest (zero velocity) within the dead zone, the focus error signal is ineffective for controlling the focusing section.

Where, for example, the focusing section is accelerated from the layer closest to disk surface L2 toward the target layer L0 under the control of the focus jump controller. In this case, the focus error signal goes to maximum positive values at points D, H, P and maximum negative values at points F, J, zero crossings at dead zones E, I, and zero crossings C, G and K corresponding to the layers L2, L1 and L0 respectively. Note that the location of the focal point with respect to the layers can be determined, for example, by counting the positive going zero crossings of the focus error signal [paragraph 0104].

In one case where, for instance, the focal point moving inward from the surface of the disk to the target layer, the inertia of the focusing section may cause the focal point to overshoot the target layer. If the overshoot is sufficiently great such the focal point is beyond the capture range of the focus detector (that is where the focal point moves beyond point P of focus error signal), the focal point may come to rest at a point (point M

of the focus error signal) where the control of the focal point is not possible unless additional control signals are applied to the focus shifting section.

In an embodiment of the invention, as described particularly at paragraphs [0118] to [0124] and shown in Fig. 10, the potential for losing control of the focus shifting section due to overshoot is eliminated by detecting the presence of a second peak of the focus error signal following the detection of a first peak of the focus error signal for the target layer. The detection of the peak of the second signal is an indication that the focal point has overshot the target layer. In the disclosed embodiment of the invention, following the detection of the second peak, the control signal is enabled to force the focal point back toward the target layer.

The control the focusing section for one embodiment of the invention is described in Figs. 8 and 10. Fig. 8 describes the control of the focusing section when the focusing section is moved away from the disk and Fig. 10 describes the control of the focusing section when the focusing section is moved toward the disk. The control is the same in each case up to step S124 Where inward shifting is occurring, detection of the S-curve (points J though M) at S228 is observed. If the S-curve is observed (i.e. the detection of first and second peaks) at the target layer, it is an indication of an overshoot and a reverse pulse is applied at step S234 to bring the focal point within the focus controllable range.

Claim Rejections – 35 U.S.C. § 103

The Examiner rejected claims 1-13 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,370,093 to Tada et al. ("Tada") in view of Japanese Patent Publication No. 05-082067 to Shibano ("Shibano"). Applicants respectfully traverse the rejection.

Amended claim 1 recites:

1. An optical disc drive comprising:

a light source;

a focusing section for focusing light emitted from the light source;

a focus shifting section for shifting a focal point of the light by changing the position of the focusing section perpendicularly to a data storage layer of a given optical disc in accordance with a control signal which is a train of pulses;

a light receiving section for receiving, at multiple areas, the light reflected from the data storage layer and generating light quantity signals representing quantities of the light received at the respective areas;

a focus error signal generating section for generating a focus error signal based on the light quantity signals; and

a control section for generating the control signal in response to the focus error signal such that the focal point of the light is transferred to a focus controllable range in which a focus control is able to be performed on the data storage layer,

wherein the control section generates the control signal such that the focal point of the light being shifted toward the data storage layer is decelerated initially at a first acceleration and then at a second acceleration, the absolute value of the second acceleration being smaller than that of the first acceleration and the control signal for decelerating the focal point of the light at the second acceleration at least includes a first type of pulses that accelerate the focal point toward the focus controllable range and a second type of pulses that accelerate the focal point away from the focus controllable range,

wherein the control section suspends controlling the focal point of the light after a first peak of the focus error signal is detected at the data storage layer, and

wherein the control section further controls the focal point of the light to be shifted toward the data storage layer, in the case where an amplitude of the focus error passes a second peak at the data storage layer.

While applicants do not agree with the Examiner's statement that the concept disclosed by Tada et al. and Shibano disclose an identical concept as the claimed

invention, Applicant's amendment to claim 1 clearly adds a feature to the control of the focusing section of a disk drive that is neither taught nor suggested by Tada or Shibano.

Amended claim 1 includes a feature which provides for the detection of overshoot and a corresponding control action to correct the problem. Neither Tada et al. nor Shibano consider the situation of an overshoot of the focusing section. As clearly shown in Figs. 18A – 18D, Tada et al. discloses an over damped system in which the deceleration pulse is initiated when the focus error signal is observed at the target layer (col. 14, lines 42-57) and terminated when the focus error signal reaches a zero crossing point (col. 16, lines 53-55), the objective lens being shown to come to rest at the conclusion of the decelerating pulses. The same feature for terminating the deceleration pulse at the second zero crossing point of the focus error signal being disclosed in each embodiment of Tada et al.'s invention.

Tada et al. assumes that focus capture occurs at the conclusion of the deceleration pulse(s) and does not make any provision for the focal point overshooting the target layer. In contrast, claim 1 recites detecting a second peak of the focus error signal and correcting the overshoot by applying additional control of the focusing section.

Shibano as best understood merely discloses a method for adjusting the acceleration voltage in a scanning electron microscope in which a first read only memory stores coarse adjustments and a second read only memory stores fine adjustments. Accordingly, Shibano does not teach or suggest the claimed features that are missing in Tada et al.

Further, since neither Tada et al. nor Shibano recognize the problem of overshoot, neither Tada nor Shibano can not possibly teach or suggest a solution to the problem. Accordingly, for all the above reasons, Applicants respectfully request reconsideration and withdrawal of the §103 rejection of claim 1.

Amended claims 11, 12 and 13 are allowable for the same reasons that amended claim 1 is allowable.

Claims 2-10 are allowable based at least on their dependency to claim 1.

Conclusion

Insofar as the Examiner's rejections have been fully addressed, the instant application, including claims 1-13 is in condition for allowance and Notice of Allowability of claims 1-13 is therefore earnestly solicited.

Respectfully submitted,

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